CLAIMS

What is claimed is:

1. An optical element, comprising:

a transparent top plate;

a substrate comprising an active area, the substrate and the top plate collectively defining a cavity;

liquid crystal material within the cavity; and

means for reducing accumulation of contaminants resulting from decomposition of the liquid crystal material due to exposure to radiation.

2. The optical element of claim 1, in which the means for reducing comprises:

a reservoir defined in at least one of the substrate and the top plate in fluid communication with the cavity; and

additional liquid crystal material within the reservoir.

3. The optical element of claim 1, in which the means for reducing comprises:

an inorganic alignment pattern defined in at least one of the top plate and the substrate, wherein the inorganic alignment pattern is in contact with the liquid crystal material.

4. The optical element of claim 1, in which the means for reducing comprises:

a pump operable to pump the liquid crystal material through the cavity across the active area.

5. The optical element of claim 4, in which the means for reducing further comprises:

a reservoir defined in at least one of the substrate and the top plate in fluid communication with the cavity; and additional liquid crystal material within the reservoir.

6. The optical element of claim 5, in which the means for reducing further comprises:

micro-fluidic channels in fluid communication with the reservoir.

7. A liquid crystal (LC) cell, comprising:

a transparent top plate;

a substrate including an active area, the substrate and the top plate collectively defining a cavity;

a reservoir in at least one of the substrate and the top plate and connected to the cavity; and;

liquid crystal material within the cavity and the reservoir.

8. The liquid crystal cell of claim 7, further comprising:

an electrode located in the reservoir operable to attract ionic contaminants.

9. The liquid crystal cell of claim 8, wherein the electrode is a first electrode and the liquid crystal light modulator additionally comprises a second electrode, the first and second electrodes connectable to receive a potential difference.

10. The liquid crystal cell of claim 9, wherein the electrodes are operable to generate a field parallel to the top plate.

11. The liquid crystal cell of claim 8, wherein the reservoir has at least one of a depth and a width at least 50 times the distance between the top plate and the substrate.

12. The liquid crystal cell of claim 8, wherein the electrode is operable to generate a field parallel to the top plate.

13. The liquid crystal cell of claim 7, wherein a portion of the liquid crystal cell is illuminated, and the reservoir is located in a non-illuminated area of the substrate.

14. The liquid crystal light modulator of claim 7, wherein the reservoir surrounds the active area.

15. The liquid crystal cell of claim 7, further comprising:

a filter that separates from the liquid crystal material contaminants formed during operation of the LC cell by decomposition of the liquid crystal material from the liquid crystal material.

16. The liquid crystal cell of claim 7, wherein the liquid crystal cell illuminated with ultraviolet light.

17. The liquid crystal cell of claim 7, wherein the substrate comprises a semiconductor.

18. The liquid crystal cell of claim 7, wherein the liquid crystal cell is a component of a spatial light modulator.

19. The liquid crystal cell of claim 7, further comprising:

an inorganic alignment pattern defined in at least one of the top plate and the substrate, wherein the inorganic alignment pattern is in contact with the liquid crystal material.

20. The liquid crystal cell of claim 7, further comprising:

a pump operable to pump the liquid crystal material through the cavity across the active area.

21. A liquid crystal (LC) cell comprising:

a top plate;

a substrate including an active area;

an inorganic alignment pattern defined in at least one of the top plate and the substrate; and

liquid crystal material that is located between the top plate and the substrate is aligned by the inorganic alignment pattern.

22. The liquid crystal cell of claim 21, wherein the inorganic alignment pattern comprises silicon dioxide.

23. The liquid crystal cell of claim 21, wherein the inorganic alignment pattern is a portion of at least one of the top plate and the substrate.

24. The liquid crystal cell of claim 21, wherein the inorganic alignment pattern is in a layer that is formed on at least one of the top plate and the substrate.

25. The liquid crystal cell of claim 21, wherein the inorganic alignment pattern is defined in the top plate, the liquid crystal cell further comprising:

another inorganic alignment pattern that is defined in the substrate.

26. The liquid crystal cell of claim 21, wherein the alignment pattern defines a plane and has surface features oriented at an oblique angle to the plane.

27. The liquid crystal cell of claim 26, wherein the oblique angle is 5 degrees from the plane.

28. The liquid crystal cell of claim 21, wherein the liquid crystal cell illuminated with ultraviolet light.

29. The liquid crystal cell of claim 21, wherein the substrate comprises semiconductor.

30. The liquid crystal cell of claim 21, wherein the liquid crystal cell is a component of a spatial light modulator.

31. The liquid crystal cell of claim 21, further comprising:

a reservoir defined in at least one of the substrate and the top plate in fluid communication the liquid crystal material; and

additional liquid crystal material within the reservoir.

32. The liquid crystal cell of claim 21, further comprising:

a pump operable to pump the liquid crystal material across the active area.

33. A liquid crystal (LC) cell, comprising:

a top plate;

a substrate including an active area, the substrate and the top plate collectively defining a cavity;

liquid crystal material within the cavity; and

a pump operable to pump the liquid crystal material through the cavity across the active area.

34. The liquid crystal cell of claim 33, wherein the pump is located in one of (a) inside and (b) outside the cavity.

35. The liquid crystal cell of claim 33, wherein the pump is one of a rotary pump, a syringe pump, and an electro-kinetic pump.

36. The liquid crystal cell of claim 33, further comprising:

a liquid crystal source for providing liquid crystal material to the cavity, and

a liquid crystal destination for receiving liquid crystal material from the cavity.

37. The liquid crystal cell of claim 33, wherein the active area has a longer axis and a shorter axis, the LC cell further comprising:

micro-fluidic channels disposed parallel to the longer axis between which the liquid crystal material flows parallel to the shorter axis.

38. The liquid crystal cell of claim 37, further comprising:

an outer seal and an inner seal located within the outer seal, the inner seal directing flow of the liquid crystal material across the active area parallel to the shorter axis.

39. The liquid crystal cell of claim 33, wherein the liquid crystal cell illuminated with ultraviolet light.

40. The liquid crystal cell of claim 33, wherein the substrate comprises semiconductor.

41. The liquid crystal cell of claim 33, wherein the liquid crystal cell is a component of a spatial light modulator.

42. The liquid crystal cell of claim 33, further comprising:

a reservoir defined in at least one of the substrate and the top plate in fluid communication with the cavity; and

additional liquid crystal material within the reservoir.

43. The liquid crystal cell of claim 33, further comprising:

an inorganic alignment pattern defined in at least one of the top plate and the substrate, wherein the inorganic alignment pattern is in contact with the liquid crystal material.

44. A photolithography system for transferring a pattern onto a substrate, the system comprising:

a source of ultraviolet light;

a spatial light modulator (SLM) arranged to receive the ultraviolet light, the SLM comprising a liquid crystal cell comprising liquid crystal material and means for reducing a build up of contaminants resulting from decomposition of the liquid crystal material due to exposure to the ultraviolet light; and

projection optics located between the SLM and the substrate.